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STAFF REPORT

PESTICIDE USE ON GRAPES IN
NEW YORK AND PENNSYLVANIA, 1979

by

W. J. Fluke,
Cleveland Marsh,
and
Craig Osteen

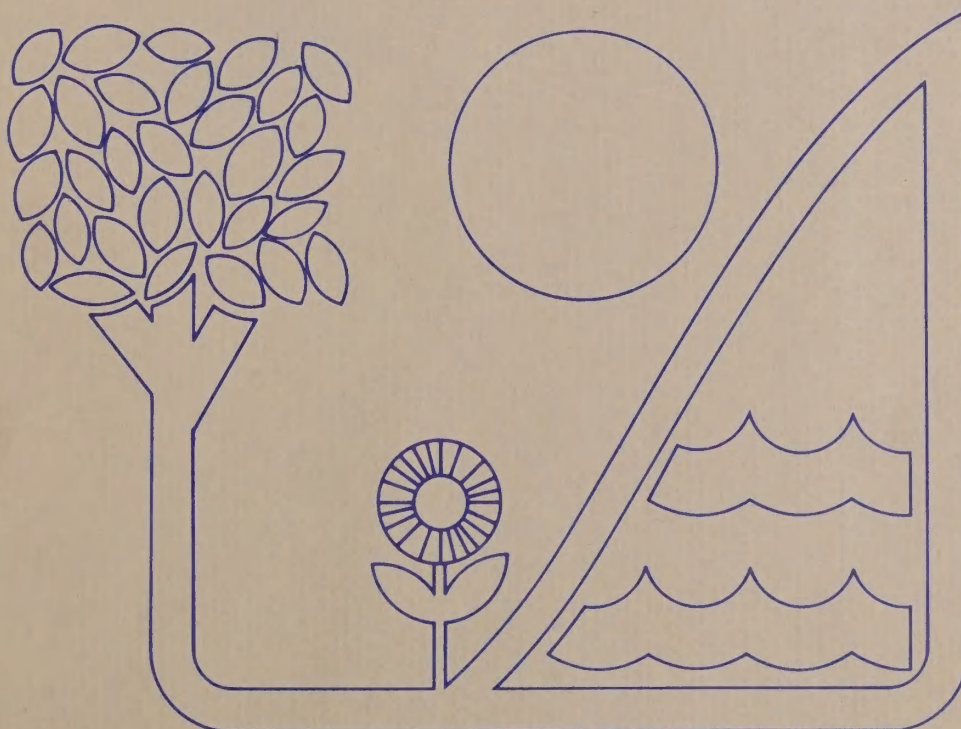
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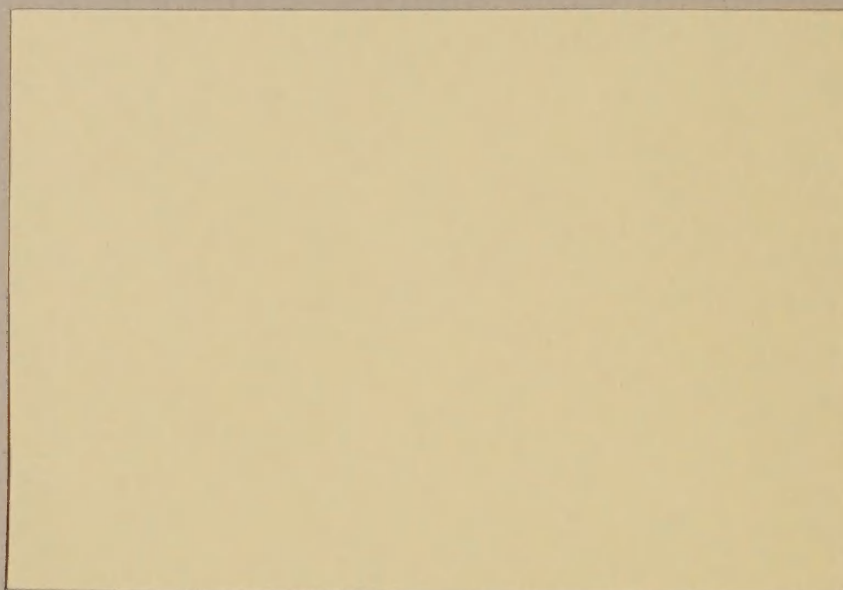
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PESTICIDE USE ON GRAPES IN NEW YORK AND PENNSYLVANIA, 1979. By W. J. Fluke, Cleveland Marsh, and Craig Osteen*; Natural Resource Economics Division, Economic Research Service, U.S. Department of Agriculture, Washington, D.C. 20250; January 1982.

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ABSTRACT

In 1979, grape growers in Pennsylvania and New York applied 496,000 pounds of pesticides (active ingredients) in 234,520 acre-treatments. Of the total quantity, 240,600 pounds were fungicides, 134,300 pounds were insecticides, and 121,200 pounds were herbicides. Approximately 38 percent of the acre-treatments were mixes of insecticides and fungicides. Coefficients of variation were computed for acres treated with specific pesticides and mixes of pesticides.

Key words: Pesticide use, grapes, New York, Pennsylvania, tank-mixes, non-chemical pest control.

* * * * *

* This paper was prepared for limited distribution to the research community outside the U.S. Department of Agriculture. Use of product names in this report is for identification only, and does not imply endorsement by the U.S. Department of Agriculture. *

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PESTICIDE USE ON GRAPES
IN NEW YORK AND PENNSYLVANIA, 1979

This report presents data on grape growers' pesticide use during 1979 in western Pennsylvania and the western and Finger Lakes areas of New York. Growers use pesticides to protect grape vines and to maintain production and quality. The Economics, Statistics, and Cooperatives Service, the New York Crop Reporting Service, and the New York State Agricultural Experiment Station cooperated in a survey of grape producers in 1979. This report presents pesticide use data on acres treated, acre-treatments, total quantities of pesticides applied, application rates per acre per treatment and per season, and the number of times applied. In addition, this report presents data on pest management practices employed by grape growers. This information should aid policymakers, researchers, extension specialists, and industry personnel in evaluating pesticide use patterns and the economic impacts of regulatory actions on specific pesticides.

METHODS AND DEFINITIONS

The growers interviewed in the 1979 Grape Pesticide Use Survey were randomly selected from lists of growers. The sample was stratified by acreage so that the medium and large vineyards were sampled more heavily than the smaller vineyards. The counties in each region were: western Pennsylvania - Erie; western New York - Cattaraugus, Chataqua, Erie, and Niagara; Finger Lakes - Monroe, Ontario, Schuyler, Seneca, Steuben, Yates, and Wayne. Enumerators employed by the State Statistical Offices personally interviewed the growers. Of the 304 growers selected, only 16 (5 percent) were inaccessible. The data were edited for completeness and accuracy. The data for each stratum were

expanded by the inverse of the sampling ratio at the stratum level and summed to estimate totals for the producing region.

Estimates based upon sample surveys have varying degrees of statistical reliability. Confidence in data depends upon sample size, sampling methods, and the variability of the responses. To provide the user of the data some indication of the reliability of the estimates, coefficients of variation (CV's) for acres treated with single-ingredient and tank-mix applications are presented in Tables 3, 5, 6, and 7. The CV is a measure of relative variation (expressed in percentage terms) and can be used to indicate the degree of confidence a user can place in the estimate. The larger the CV, the less reliable the estimate.

In simplest terms, it can be said that there is 95 percent confidence that the sample represents the true population and that the true value for the population lies within an interval defined as the estimated value ± 2 CV's times the estimated value. For example, with a CV of 10 percent and an estimate of 40, the interval would be 32 to 48. However, there is also the unlucky 5 percent chance that the true value does not fall within the interval as defined above because the sample is not representative of the population.

CV's were calculated only for acres treated with specific pesticides. The estimates of acres treated are expected to have greater variation than other data reported. Consequently, for most other information included in this report, the level of reliability should be equal to or greater than reported for acres treated.

Definitions important in interpreting the data are as follows:

Active ingredient - The portion of the pesticide product which controls the pest. All quantities and application rates are reported in pounds of active ingredient.

Acres treated - The area treated with a pesticide or pesticide mix one or more times. Summing acres treated with different pesticides can result in double-counting since more than one pesticide can be used on the same acre.

Acre-treatments - Acres treated with a pesticide multiplied by the number of times it was applied. Acre-treatments of different pesticides or mixes can be summed without double-counting.

Fungicides - Materials that control diseases.

Herbicides - Materials that control weeds.

Insecticides - Materials that control insects.

Pesticide mixes - Two or more active ingredients that are formulated together and sold as a product.

Tank-mixes - Two or more pesticides mixed in the same spray tank by the grower and applied together.

Stages of grape development - Division of the crop year when pesticides are applied.

Dormant - The period from harvest to the time just prior to new growth, budding, or greening for the next crop.

Pre-bloom - The period from new growth, budding, or greening up to bloom burst.

Post-bloom - The period of time after blossom buds are all open and extending to harvest.

VINEYARD ACREAGE AND GRAPE PRODUCTION

The total 1979 acreage of vineyards in the sampled areas was 49,300 acres with only 640 acres (1 percent) not of bearing age (Table 1). These vineyards produced 444 million pounds of grapes in 1979; of this total, 66 percent went for sweet juice used for juices, jellies, and jams, and 34 percent went for wine.

Table 1. Acres in vineyards, production, and primary use of production in 1979 ^{a/}

	: Acres in vineyards :				: Primary use :		
Region,	:	:	: Non-	:	Total	:	: Sweet: Fresh
variety	: Total	: Bearing	: bearing	:	production	: Wine	: juice: market
	-----Acres-----				1,000 lbs.	Percent of production	
WESTERN NY AND PA							
Native varieties							
Catawba	1,180	1,175	5		8,005	98	2 0
Concord	31,270	31,140	130		315,145	9	91 0
Delaware	790	790	0		5,685	91	9 0
Niagara	1,000	1,000	0		7,055	42	57 1
Other	210	205	5		1,705	85	14 1
Total	34,450	34,310	140		337,595	14	86 * b/
French varieties							
Aurora	130	130	0		505	100	0 0
Baco Noir	90	90	0		340	61	0 39
de Chaunac	160	160	0		880	100	0 0
Other	190	180	10		790	95	0 5
Total	570	560	10		2,515	93	0 7
Region Total	35,020	34,870	150		340,110	14	86 *
FINGER LAKES							
Native varieties							
Catawba	2,560	3,490	70		17,610	100	0 0
Concord	4,000	3,990	10		34,610	97	3 *
Delaware	1,290	1,250	40		6,025	100	0 0
Niagara	1,190	1,170	20		8,240	100	0 0
Other	1,270	1,180	90		7,575	100	0 *
Total	10,310	10,080	230		74,060	99	1 *
French varieties							
Aurora	1,490	1,415	75		11,260	100	0 0
Baco Noir	350	1,330	20		2,060	100	0 0
de Chaunac	800	760	40		9,590	100	0 0
Rougeon	250	250	0		2,430	100	0 0
Other	810	695	115		3,760	100	0 0
Total	3,700	3,450	250		29,100	100	0 0
Viniferas	240	230	10		580	100	0 0
Region Total	14,250	13,760	490		103,740	99	1 *
TOTAL,							
BOTH REGIONS	49,270	48,630	640		443,850	34	66 *

^{a/} 1979 Grape Pesticide Use Survey, Natural Resource Economics Division, ESCS, USDA.

^{b/} "*" is a very small amount.

Grape producers in western Pennsylvania and western New York diverted 86 percent of their grapes for sweet juice and 14 percent for wine. Vineyards in this area contained 35,000 acres, of which only 150 were of non-bearing age. Vineyard operators had 31,260 acres of Concord, 1,180 of Catawba, and 1,000 of Niagara grapes. These vineyards produced 340 million pounds of grapes. Of the production by variety, 99 percent of the Concords and 51 percent of the Niagaras were for sweet juice while 98 percent of the Catawbas and 49 percent of the Niagaras were for wine.

The Finger Lakes region produces grapes primarily for wine. Vineyards in this region totaled 14,250 acres, of which 490 were of non-bearing age. Vineyard operators had 4,000 acres of Concord, 2,560 of Catawba, 1,400 of Aurora, and 1,190 of Niagara grapes. Vineyards in the Finger Lakes region produced 104 million pounds of grapes in 1979 of which 99 percent went for wine and 1 percent for sweet juice. Wineries purchased 97 percent of the Concords and 100 percent of the Auroras, Catawbas, and Niagaras.

GENERAL PEST CONTROL PRACTICES

Growers treated 95 percent of the vineyard acreage with pesticides (46,600 acres). In the Finger Lakes region, growers treated 99 percent of the vineyard acreage while growers in Pennsylvania and western New York treated 93 percent. Growers applied 496,000 pounds of active ingredient (a.i.) in 234,520 acre-treatments. Approximately 38 percent of the acre-treatments (90,010) were mixes of fungicides and insecticides. Of the total quantity of pesticides, 91 percent were purchased as wettable or soluble powders and 9 percent as liquids. Approximately 66 percent of all acre-treatments included fungicides, 47 percent included insecticides, and 25 percent included herbicides. On the average, each grower applied approximately 10.6 pounds (a.i.) of pesticides per acre

treated in 5 treatments. Vineyard operators applied 92 percent of the acre-treatments while custom applicators made 8 percent. There was no aerial application of pesticides reported.

SPRAY SCHEDULES, SCOUTING, AND IPM

Spray schedules determined pesticide use on 45,100 acres. Operators followed spray schedules recommended by the experiment station or extension service on 85 percent of the acreage and by pesticide dealers or private consultants on 3 percent. Operators determined schedules on 12 percent. Scouting and integrated pest management (IPM) practices were rare. Operators reported that 1,480 acres were scouted for pest problems or were under an integrated pest management program.

CULTURAL WEED CONTROL

Growers cultivated 96 percent of the vineyard acreage. Of the cultivated acreage, 60 percent was cultivated 3 or more times while 40 percent was cultivated 2 or fewer times. Hand-hoeing was used on 14 percent of the vineyard acreage. Growers also used a rotary mower on 95 percent of the vineyard acreage to chop prunings and control growth between rows.

PESTICIDE USE

The survey results show tank-mixes of fungicides plus insecticides to be a very large proportion of all pesticide use. As a result, the section on fungicides presents total fungicide use, single-ingredient fungicide applications, and mixes of fungicides with other fungicides. We discuss insecticides in the same manner. Then, we report tank-mixes of fungicides and insecticides, and finally, herbicides.

FUNGICIDES

Total Fungicide Use

Fungicides were the most used group of pesticides in 1979 with 240,600 pounds (a.i.) applied in 153,700 acre-treatments: 52,750 as single-ingredients, 11,010 as fungicide mixes, and 90,010 as fungicide and insecticide mixes. Growers reported that the primary diseases were black rot and mildew, accounting for 30 and 67 percent of the acre-treatments, respectively.

The most used fungicides were benomyl, captan, and folpet; they were applied in 49 percent of the acre-treatments including fungicides and account for 66 percent of the quantity of fungicides (Table 2). Growers applied 23,100 pounds (a.i.) of benomyl in 45,700 acre-treatments, 78,000 pounds of captan in 51,800 acre-treatments, and 56,000 pounds of folpet in 35,300 acre-treatments. (See Table 3 for mixes.) Copper compounds, ferbam, and sulfur were applied in approximately 22 percent of the acre-treatments including fungicides and account for 33 percent of the total quantity of fungicides.

Vineyard operators applied 94 percent of all fungicide acre-treatments while custom applicators applied 6 percent. Ground air blast equipment was used for 66 percent of the acre-treatments, a vertical boom for 23 percent, and other equipment for 11 percent. Growers applied all fungicides directly to the vine with 21 percent of the acre-treatments made during the pre-bloom, 78 percent during the post-bloom, and 1 percent during the dormant period.

Single-Ingredient Applications

Growers applied 70,330 pounds (a.i.) of fungicides singly in 52,750 acre-treatments (Table 3). Captan was the most used with 26,800 acre-treatments used and 17,910 pounds applied. Benomyl was second in terms of acre-treatments with 7,640. However, benomyl was sixth in terms of total quantity with 3,650 pounds (a.i.) because it was applied at a relatively low rate of 0.5 pounds

Table 2. Fungicides used on grapes in New York and Pennsylvania, 1979 a/

Active ingredient b/	:	:	:	:	:	:
	: Acres	: Acre-	: Total	: Rate per acre	: per	: Times
	:treated	:treatments	: quantity	:season	:treatment	:applied
	-----1,000-----		1,000 lbs.(a.i.)	---Lbs.(a.i.)---		No.
Benomyl	27.8	45.7	23.2	0.8	0.5	1.7
Captan	21.8	51.8	78.0	3.6	1.5	2.4
Copper compounds	10.7	15.9	26.0	2.4	1.6	1.5
Dichlone	.6	1.2	.2	.3	.1	2.0
Dinocap	2.6	4.8	2.1	1.0	.5	1.8
Ferbam	9.0	13.1	23.3	2.6	1.8	1.5
Folpet	19.7	35.3	56.0	2.8	1.6	1.8
Sulfur	6.6	18.4	31.9	4.8	1.7	2.8
Total	- <u>c/</u>	- <u>c/</u>	240.6	- <u>c/</u>	- <u>c/</u>	- <u>c/</u>

a/ 1979 Grape Pesticide Use Survey, Natural Resource Economics Division, ESCS, USDA.

b/ The totals for these active ingredients include single-ingredient applications, fungicide mixes, and fungicide and insecticide mixes which are presented in more detail in Tables 3 and 6.

c/ Since some of the fungicide products have been mixed and applied together, summing acres treated and acre-treatments results in double counting.

Table 3. Single ingredient applications and mixes of fungicides in New York and Pennsylvania, 1979 a/

	:	:	:	:	: <u>Rate per acre</u> :			
	:	Acres	Acres	Total	: <u>per</u> : Times			
Active ingredient	:	treated	treatments	quantity	:season:	treatment:applied		
					----- <u>Lbs.(a.i.)</u> -----			
					<u>No.</u>			
	b/							
<u>Single applications</u>								
Benomyl	6,950	(22)	7,640	3,650	0.5	0.5	1.1	
Captan	14,880	(6)	17,910	26,800	1.8	1.5	1.2	
Copper compounds	4,530	(14)	5,770	9,300	2.1	1.6	1.3	
Dinocap	3,490	(33)	3,490	1,510	.4	.4	1.0	
Ferbam	3,790	(19)	4,260	7,070	1.9	1.7	1.1	
Folpet	5,040	(22)	5,950	9,760	1.9	1.6	1.2	
Sulfur	5,620	(9)	7,730	12,240	2.2	1.6	1.4	
Total	- c/		52,750	70,330	- c/		1.3	- c/
<u>Mixes</u>								
Benomyl	2,680	(20)	3,230	1,510	.6	.5	1.2	
+ captan				3,530	1.3	1.1		
Benomyl	400	(64)	400	120	.3	.3	1.0	
+ folpet				580	1.5	1.5		
Benomyl	460	(41)	720	620	1.4	.9	1.6	
+ sulfur				910	2.0	1.3		
Captan	510	(65)	1,020	1,020	2.0	1.0	2.0	
+ copper compounds				1,080	2.1	1.1		
+ ferbam				1,550	3.0	1.5		
+ folpet				1,020	2.0	1.0		
Captan	1,190	(0)	1,190	1,190	1.0	1.0	1.0	
+ copper compounds				1,260	1.1	1.1		
Captan	1,370	(32)	2,270	2,660	1.9	1.2	1.7	
+ sulfur				3,870	2.8	1.7		
Dichlone	580	(0)	1,150	160	.3	.1	7.0	
+ sulfur				3,470	6.0	3.0		
Ferbam	680	(52)	680	1,290	1.9	1.9	1.0	
+ folpet				850	1.3	1.3		
Other	- c/		350	860	- c/		2.5	- c/
Total	- c/		11,010	27,550	- c/		2.5	- c/

a/ 1979 Grape Pesticide Use Survey, Natural Resource Economics Division, ESCS, USDA.

b/ Coefficients of variation for acres treated (in percent) are in parentheses. The coefficient is the standard error of the estimate multiplied by 100 and divided by the estimate. The coefficient is a measure of precision; the lower the coefficient, the more precise is the estimate.

c/ Summing acres treated would result in double-counting.

(a.i.) per acre-treatment. Sulfur ranked third in acre-treatments with 7,730, while it ranked second in total quantity with 12,240 pounds (a.i.). Sulfur was applied at a relatively high rate of 1.6 pounds (a.i.) per acre-treatment. The ranking of the remaining fungicides by acre-treatments follows: folpet, copper compounds, ferbam, and dinocap. Growers often applied single ingredients more than once per acre treated, ranging from 1 time for dinocap to 1.4 times for sulfur.

Fungicide Mixes

Growers applied a small portion of fungicides in mixes with other fungicides; 27,550 pounds (a.i.) in 11,010 acre-treatments at approximately 2.5 pounds per acre-treatment. The most widely used tank-mix was benomyl plus captan with 3,230 acre-treatments. The second most widely used tank-mix consisted of 2,270 acre-treatments of captan plus sulfur.

INSECTICIDES

Total Insecticide Use

Growers applied 134,300 pounds (a.i.) of insecticides in 110,910 acre-treatments of which 20,200 were single-ingredient applications, 700 were insecticide mixes, and 90,010 were fungicide and insecticide mixes. Growers reported the two major insect pests as berry moths, accounting for 51 percent of the acre-treatments, and leafhoppers, accounting for 25 percent.

The two most widely used insecticides were carbaryl and parathion which accounted for 91 percent of the total quantity and 88 percent of the acre-treatments including insecticides. Growers applied 105,900 pounds (a.i.) of carbaryl in 58,900 acre-treatments and 16,700 pounds of parathion in 40,100 acre-treatments (Table 4). Methyl parathion and azinphos-methyl accounted for 6 percent of the quantity and 13 percent of the acre-treatments including

Table 4. Insecticides used on grapes in New York and Pennsylvania, 1979 a/

Active ingredient b/	:	:	:	:	:	:
	Acres	Acre-	Total	Rate per acre	per	Times
	treated	treatments	quantity	season	treatment	applied
			1,000			
	-----1,000-----		lbs.(a.i.)	---Lbs.(a.i.)---		No.
Azinphos-methyl	3.6	5.7	2.6	0.7	0.4	1.6
Carbaryl	26.3	58.9	105.9	4.0	1.8	3.0
Dicofol	.9	1.3	1.3	1.4	1.0	3.4
Malathion	.3	.3	.3	1.0	1.0	1.0
Methoxychlor	.8	1.3	1.5	1.9	1.2	1.6
Methyl parathion	4.7	8.9	4.6	1.0	.5	1.9
Parathion	17.7	40.1	16.7	.9	.4	2.3
Phosalone	.5	.7	.7	1.4	1.0	1.4
Phosmet	.3	.4	.6	2.0	1.5	1.3
Other	.2	.3	.1	.5	.3	1.5
Total	- <u>c/</u>	- <u>c/</u>	134.3	- <u>c/</u>	- <u>c/</u>	- <u>c/</u>

a/ 1979 Grape Pesticide Use Survey, Natural Resource Economics Division, ESCS, USDA.

b/ The totals for these active ingredients include insecticides used in single-ingredient applications, insecticide mixes, and fungicide and insecticide mixes which are presented in more detail in Tables 5 and 6.

c/ Since some of the insecticide products have been mixed and applied together, summing acres treated and acre-treatments results in double counting.

insecticides.

Vineyard operators and custom applicators made 94 percent and 6 percent, respectively, of the acre-treatments including insecticides. Ground air blast equipment was used for 57 percent of the acre-treatments, a vertical boom for 29 percent, and other equipment for 14 percent. Growers applied all insecticide treatments directly to the vine with 15 percent during the pre-bloom, 84 percent during the post-bloom, and 1 percent during the dormant period.

Single-Ingredient Applications

Growers applied 23,070 pounds (a.i.) of insecticides, singly, in 20,200 acre-treatments (Table 5). Carbaryl and parathion were the two most widely used. Growers applied 19,940 pounds (a.i.) of carbaryl in 10,690 acre-treatments and 1,500 pounds of parathion in 6,500 acre-treatments. They applied each an average of 1.3 times per acre treated. Other insecticides applied singly include azinphos-methyl, methyl parathion, methoxychlor, and phosmet for 2,840 acre-treatments. Azinphos-methyl was applied 1.8 times per acre treated while the others were applied 1 time.

Insecticide Mixes

Growers applied very few mixes which include only insecticides. They applied 1,470 pounds (a.i.) in 700 acre-treatments (Table 5). Carbaryl was mixed with methoxychlor or parathion in 520 acre-treatments. Each mix was applied once per acre treated.

FUNGICIDE AND INSECTICIDE MIXES

Grape growers applied 51 percent of the quantity and 38 percent of the acre-treatments of pesticides as mixes of fungicides and insecticides. A total of 252,370 pounds (a.i.) of insecticides and fungicides were applied in

Table 5. Single ingredient applications and mixes of insecticides in New York and Pennsylvania, 1979 a/

	:	:	:	:	: Rate per acre :		:
	:	Acres	:	Acre-	:	Total	:
	:	treated	:	treatments	:	quantity	:
Active ingredient	:		:		:	season:treatment:	applied

a/ 1979 Grape Pesticide Use Survey, Natural Resource Economics Division, ESCS, USDA.

b/ Coefficients of variation for acres treated (in percent) are in parentheses. The coefficient is the standard error of the estimate multiplied by 100 and divided by the estimate. The coefficient is a measure of precision; the lower the coefficient, the more precise is the estimate.

c/ Summing acres treated would result in double-counting.

90,010 acre-treatments. Of the total quantity, 109,700 pounds (a.i.) were insecticides and 142,670 pounds were fungicides (Table 6). Growers applied approximately 2.8 pounds of active ingredient per acre-treatment of which 1.2 pounds were insecticides and 1.6 pounds were fungicides. Growers often applied fungicide and insecticide mixes more than once, ranging from 1.0 to 1.5 times per acre treated.

The two most commonly used insecticides in these mixes were carbaryl and parathion. Growers used 75,330 pounds (a.i.) of carbaryl in 47 percent of the acre-treatments, and 15,170 pounds (a.i.) of parathion in 33 percent (Table 6). The most commonly used fungicides in these mixes were benomyl, captan, and folpet. Growers applied 15,950 pounds (a.i.) of benomyl in 35 percent of the acre-treatments, 41,820 pounds of captan in 29 percent, and 40,810 pounds of folpet in 30 percent.

The three most widely used mixes were carbaryl plus benomyl, captan, or folpet, which accounted for 34,520 (38 percent) of the acre-treatments of fungicide and insecticide mixes. Carbaryl plus folpet was the most used mix with 13,740 acre-treatments (15 percent). Carbaryl plus captan accounted for 10,630 acre-treatments (12 percent) while carbaryl plus benomyl accounted for 10,150 (11 percent). The fourth and fifth most used mixes were parathion plus benomyl or copper compounds with 8,460 (9 percent) and 7,240 (8 percent) acre-treatments, respectively.

HERBICIDES

Growers applied 121,210 pounds (a.i.) of herbicides in 59,850 acre-treatments of which 50,070 were single-ingredient applications and 9,780 were mixes (Table 7). The most widely used herbicide was diuron accounting for 63 percent of the total quantity and 59 percent of the acre-treatments. Diuron

Table 6. Mixes of fungicides and insecticides used in New York and Pennsylvania 1979, a/

Active ingredient	:	:	:	: Rate per acre :		:
	: Acres	: Acre-	: Total	: per	: Times	
	: treated	: treatments	: quantity	: season:	: treatment:	: applied
	<u>b/</u>			-----Lbs. (a.i.)-----		No.
Benomyl	1,500 (44)	1,980	1,470	1.0	0.7	1.3
+ captan			4,920	3.3	2.5	
+ carbaryl			5,520	1.3	1.1	
Benomyl	1,870 (37)	1,970	810	.4	.4	1.1
+ captan			2,970	1.6	1.5	
+ insecticides			1,820	1.0	.9	
Benomyl	6,859 (14)	10,150	5,880	.8	.6	1.5
+ carbaryl			18,990	2.7	1.9	
Benomyl	5,540 (26)	5,560	1,850	.3	.3	1.0
+ folpet			8,850	1.6	1.6	
+ insecticides			5,700	1.0	1.0	
Benomyl	2,740 (39)	2,940	1,470	.5	.5	1.1
+ methyl parathion			1,620	.6	.6	
Benomyl	7,000 (21)	8,460	4,480	.6	.5	1.2
+ parathion			5,120	.7	.6	
Captan	7,890 (16)	10,630	16,180	2.1	1.5	1.3
+ carbaryl			15,190	1.9	1.4	
Captan	2,400 (23)	3,490	4,940	2.1	1.4	1.5
+ carbaryl			6,180	2.6	1.8	
+ fungicides			4,480	.7	1.3	
Captan	2,300 (22)	2,710	4,360	1.9	1.6	1.2
+ parathion			1,200	.5	.4	
Captan	2,060 (26)	2,770	4,220	2.1	1.5	1.3
+ parathion			930	.5	.3	
+ sulfur			5,610	2.7	2.1	
Captan	1,600 (16)	2,100	2,840	1.8	1.4	1.3
+ fungicides			3,460	2.2	1.6	
+ insecticides			1,190	.8	.6	
Carbaryl	2,240 (31)	2,380	4,780	2.1	2.0	1.1
+ ferbam			4,400	2.0	1.9	
Carbaryl	9,200 (17)	13,740	24,670	2.7	1.8	1.5
+ folpet			22,920	2.5	1.7	

-- continued

Table 6. Mixes of fungicides and insecticides used in New York and Pennsylvania, 1979, a/ -- continued

Active ingredient	:	:	:	:	:	:
	Acres	Acres	Total	Rate per acre	per	Times
	treated	treatments	quantity	season	treatment	applied
	<u>b/</u>			-----Lbs. (a.i.)-----		No.
Copper compounds + parathion	6,440 (21)	7,240	12,950 5,090	2.0 .8	1.8 .7	1.1
Ferbam + parathion	1,540 (52)	1,540	3,110 500	2.0 .1	2.0 .1	1.0
Folpet + insecticides	6,240 (20)	6,530	9,760 2,610	1.3 .5	1.1 .4	1.1
Fungicides + insecticides	- <u>c/</u>	5,820	10,740 8,590	- <u>c/</u> -	1.8 1.5	- <u>c/</u>
TOTAL	- <u>c/</u>	90,010	252,370	- <u>c/</u>	2.8	- <u>c/</u>
Insecticides	-	90,010	109,700	-	1.2	-
Fungicides	-	90,010	142,670	-	1.6	-

a/ 1979 Grape Pesticide Use Survey, Natural Resource Economics Division, ESCS, USDA.

b/ Coefficients of variation for acres treated (in percent) are in parentheses. The coefficient is the standard error of the estimate multiplied by 100 and divided by the estimate. The coefficient is a measure of precision; the lower the coefficient, the more precise is the estimate.

c/ Summing acres treated would result in double-counting.

Table 7. Single ingredient applications and mixes of herbicides in New York and Pennsylvania, 1979 a/

Active ingredient	:	:	:	: Rate per acre :		: Times applied
	: Acres	: Acre-	: Total	: per	: treatment	
	: treated	: treatments	: quantity	: season	: treatment	: applied
				-----Lbs. (a.i.)-----		No.
<u>Single applications</u>	<u>b/</u>					
Dinoseb	1,210 (36)	1,280	1,410	1.2	1.1	1.1
Diuron	26,730 (8)	26,730	60,640	2.3	2.3	1.0
Glyphosate	5,450 (16)	5,480	9,290	1.7	1.7	1.0
Paraquat	8,740 (19)	9,610	8,080	.9	.8	1.1
Simazine	6,970 (15)	6,970	16,740	2.4	2.4	1.0
Total	- <u>c/</u>	50,070	96,160	- <u>c/</u>	1.9	- <u>c/</u>
<u>Mixes</u>						
Dinoseb	790 (56)	790	500	.6	.6	1.0
+ diuron			2,430	3.1	3.1	
Diuron	5,270 (19)	5,270	9,520	1.8	1.8	1.0
+ paraquat			2,240	.4	.4	
Diuron	2,700 (35)	2,700	3,970	1.5	1.5	1.0
+ simazine			4,180	1.5	1.5	
Paraquat	600 (58)	600	450	.7	.7	1.0
+ simazine			680	1.1	1.1	
Other mixes	- <u>c/</u>	420	1,080	- <u>c/</u>	2.6	1.0
Total	- <u>c/</u>	9,780	25,050	- <u>c/</u>	2.6	- <u>c/</u>
TOTAL, ALL HERBICIDES	- <u>c/</u>	59,850	121,210	- <u>c/</u>	2.0	- <u>c/</u>

a/ 1979 Grape Pesticide Use Survey, Natural Resource Economics Division, ESCS, USDA.

b/ Coefficients of variation for acres treated (in percent) are in parentheses. The coefficient is the standard error of the estimate multiplied by 100 and divided by the estimate. The coefficient is a measure of precision; the lower the coefficient, the more precise is the estimate.

c/ Summing acres treated would result in double-counting.

was applied in 53 percent of the acre-treatments with single ingredients and 90 percent of the mixes. Growers applied 76,560 pounds (a.i.) of diuron in 35,490 acre-treatments of which 26,730 were single-ingredient applications and 8,760 were mixes. Growers mixed diuron with dinoseb, paraquat, and simazine. Diuron was applied once per season at an average rate of 2.2 pounds (a.i.) per acre-treatment.

Growers also applied 44,650 pounds (a.i.) of glyphosate, paraquat, and simazine. They applied dinoseb in 2,150 acre-treatments (including mixes), glyphosate in 5,810, paraquat in 14,880, and simazine in 10,350. Only paraquat and dinoseb, in single-ingredient applications, were applied more than once per season.

Growers banded 90 percent of the herbicide acre-treatments and spot-treated the remaining 10 percent. They made 69 percent of the herbicide acre-treatments during the dormant, 29 percent during the pre-bloom, and 2 percent during the post-bloom period.

